Research and Development Programme for Breeding & Seed Production[1]

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[1] Paper presented to PT Socfindo Tenera Gathering and Tour 2007. Medan, Indonesia. 11 – 13 June 2007

Aek Loba June 2007

Research and Development Programme for Breeding & Seed Production

Introduction

This programme contributes to the long term productivity improvement at PT Socfindo and the other companies of Socfinal Group. It will allow the company to propose to its consumers the better planting material adapted to their needs.

Objectives:

- Develop planting material with high yield and extraction rate and also:
    - Palms better adapted to specific environmental conditions
    - Tolerance to various stress factors such as drought, wind, temperature, etc.
    - Palms better adapted to specific nutrient requirements
    - Resistance or tolerance to specific diseases and pests, such as Ganoderma, Fusarium wilt, *Oryctes*, etc.
    - Economic considerations such as; fast/slow growth, height increment, high bunch number/low weight or low bunch number/high weight, high extraction/lower bunch weight, sex ratio, CPO/PK ratio, compact palms, etc.
    - Downstream or end-user requirements such as olein / stearin ratio, IV and carotene content, etc
- Produce high potential planting material through the sexual and cloning way

Organisation

The program can divide up itself in 2 main parts according the objectives:

- Variety creation
- Variety propagation

Variety creation

The variety creation includes all the operations introducing new germplasm, creating improved germplasm and evaluating this germplasm through progeny trials. Three operations are running for the part of the programme:

1. Breeding programme

Mainly implemented at PSBB, this operation is focusing on the preparation of the planting material for the future variety creation. It is subdivided in several actions as:

- Maintenance of the collection
- Preparation of Aek Kwasan II progeny trials
- Preparation of parental garden
- Studies for Marker Assisted Selection[2] and Certipalm
- Breeding for Ganoderma tolerance[3]
- Breeding for Wilt disease tolerance[4]
- Recombination and breeding for the future

2. Aek Loba Timur genetic bloc

Covering 5 years of planting (1995 and 1997 to 2000) and nearly 490 ha (including borders), it consists of large set of progeny trials evaluating improved germplasm from SRPH Pobé and PSBB. Few additional clone tests produced by the former Socfindo Vegetative Propagation laboratory complete the bloc.

The full bloc includes:

- Tests of Pobé Improved Germplasm
  - 2 Deli * Yangambi trials
  - 16 Deli * La Mé trials
- Tests of PSBB Improved Germplasm
  - 7 Deli * La Mé, Yangambi, Nifor or Kuala Krapuh trials
- Clone tests
  - 3 Deli * La Mé trials issuing from Aek Kwasan I Bloc

Group 1: Tests of genitors from Pobé

Trial	Number Of treatments	Design	Planting Date	Block	Progeny types
AL GP 01	25	Lattice 5x5	10/1995	41A	(DA5D x DA3D) x La Mé
AL GP 02	25	Lattice 5x5	10/1995	41B	(LM269D x DA128D) x Yangambi
AL GP 03	25	Lattice 5x5	11/1995	42B	(DA115D x DA3D) x La Mé
AL GP 04	25	Lattice 5x5	11/1995	42A	(DA10D x DA115D) x La Mé
AL GP 06	16	Lattice 4x4	04/1997	44A	(DA551D x DA767D) or (LM269D x DA128D) x (LM238T x LM511P) or (LM718T x LM238T)

[2] One genetic trial is specially addressing these studies : ALGP 29 planted in 2003 following the INCO-DEV LINK-2-PALM project
[3] See the R & D programme for Crop Protection : Integrated Management of the BSR
[4] See the R & D programme for Crop protection : Integrated management of the Wilt Disease

AL GP 07	25	Lattice 5x5	04/1997	44B	LM404D, DA3D, DA10D, DA115D recombination x La Mé
AL GP 08	25	Lattice 5x5	04/1997	45A/C	(DA10D x DA3D) x La Mé
AL GP 09	25	Lattice 5x5	04/1997	45B/D	(DA115D self) x La Mé
AL GP 10	16	Lattice 4x4	04/1997	46A	(LM269D x DA115D) x La Mé
AL GP 11	25	Lattice 5x5	10/1997	31A/C	(DA300D x DA128D) x La Mé
AL GP 12	20	Fisher R6	10/1997	31B	LM269D, DA3D, DA5D, DA10D and DA115D recombination x La Mé
AL GP 13	25	Lattice 5x5	10/1997	32A/C	DA3D, DA10D and DA115D recombination x La Mé
AL GP 14	25	Lattice 5x5	10/1997	32B	LM404D, DA3D and DA10D recombination x La Mé
AL GP 20	25	Lattice 5x5	10/1998	34B	DA3D, DA5D, DA10D and DA115D recombination x La Mé
AL GP 21	25	Lattice 5x5	11/1998	23A 24B	LM269D, DA10D and DA115D recombination x La Mé
AL GP 26	25	Lattice 5x5	04/2000	37A/C	DA3D, DA5D, DA10D and DA115D recombination x La Mé
AL GP 27	25	Lattice 5x5	05/2000	37B/D	(DA115D self) x La Mé
AL GP 28	25	Lattice 5x5	05/2000	26A/B	DA10D, DA115D, DA128D, DA300D, LM404D recombination x La Mé

Group 2: Tests of genitors from Bangun Bandar

Trial	Nbr of treatments	Design	Planting Date	Block	Progeny types
AL GP 15	25	Lattice 5x5	11/1997	33A/C	(LM269D x DA128D) ou (BB126D x BB150D) x Yangambi
AL GP 16	25	Lattice 5x5	11/1997	33B/D	(BB126D x BB150D) x BB85Tself or (BB85T x BB20P)
AL GP 17	25	Lattice 5x5	11/1997	22A/C/ B	(BB126D x BB150D), (BB177D x BB129D) ou BB206D self x La Mé or Yangambi
AL GP 18	18	Fisher R6	05/1998	22A/B	(BB126D x BB150D), (BB177D x BB129D) or BB206D self x Nifor
AL GP 23	16	Lattice 4x4	02/1999	36B	(BB126D x BB150D), (BB177D x BB129D) or BB206D self x Nifor or Yangambi
AL GP 24	25	Lattice 5x5	03/1999	35A/C	(Deli x Angola) Second cycle x La Mé
AL GP 25	25	Lattice 5x5	03/1999	35B/D	(Deli x Angola) Second cycle x La Mé

Group 3: Tests of clones coming from Aek Kwasan genetic block

Trial	Nbr of treatments	Design	Planting Date	Block	Progeny types
AL GP 05	25	Lattice 5x5	11/1995	43A/B	Clones PSBB
AL GP 19	12	Fisher R6	06/1998	34A	Clones PSBB
AL GP 22	17	Fisher R6	11/1998	25B	Clones PSBB

The bloc has been completed with introduction of parental garden from A & B groups witch is not yet completed. The complement is running actually under a MTA with SRPH Pobé since 3 years.

3. Aek Kwasan II project

The planting material currently produced by PSBB is coming from Aek Kwasan I and Aek Loba Timur genetic blocks. The objective of the project Aek Kwasan II is to assure a variety creation program able to take the continuation and to ensure the progression of the potential of PT Socfindo and of its customer's plantations from the years 2015. It is based on the exploitation of the body of the available PSBB genetic resources.

It will take into account equally new orientations to complete the predominant selection criteria (yield and extraction) in order to promote the vision of the future expressed by the company and the industry:

Some of the additional requirements may be:

- Palms better adapted to specific environmental conditions (drought, temperature, low insulation…)
- Palms better adapted to specific nutrient requirements (boron deficiency …)
- Resistance or tolerance to specific diseases and pests, such as *Ganoderma*, *Fusarium* wilt, *Oryctes*, etc.
- Economic considerations such as; fast/slow growth, height increment, high bunch number/low weight or low bunch number/high weight, high extraction/lower bunch weight, sex ratio, CPO/PK ratio, compact palms, etc.
- Downstream or end-user requirements such as olein / stearin ratio, IV and carotene content, etc.

Begun in 2002 by the crossing maps implemented at PSBB, it will spread himself on 690 hectares (including borders) in the division VI of Aek Loba Estate. It contains:

- 10 ha for the new Collection Park transferred from PSBB
- 24 progeny trials
- 200 ha of parental garden for both the A & B groups

Started in 2004 with few hectares of Collection, its set up should finish itself in 2010.

4. Correlated programmes

With R & D for Crop protection:

An evidence of genetic differences in the behaviour against the BSR has been proven from the results of progeny trials planted at PSBB since the eighties. At the end of the nineties, a large screening test on field has been proposed. It has been realised and planted on Mata Pao, Bangun Bandar and Tanah Gambus estates. Its objectives are to detect some tolerant planting material able to be propagated as well by sexual way as by clone one. This operation is currently covering 329 ha. In addition, joint work realised with Cirad and Lonsum under a specific agreement has successfully given the first “draft” of a screening test usable in prenursery. The first confirmative screening tests will be implemented soon at the Tanah Gambus Phytopathology Laboratory (TGPL).

Variety propagation

1. Commercial seed production

From 2000, an important revision and remittance in order programme of PT Socfindo seed production was implemented. All the procedures were

scrutinised and PSBB was qualified ISO 9001 - 2000 in November 2001. The seed production programme is built on the exploitation of the general combining abilities of the parents detected as well in the Cirad network as in the genetic blocks of Aek Kwasan I and Aek Loba Timur. The current program allows producing about 45 million dry seeds per annum with a sale capacity of 34 to 35 million germinated seeds germinated. A park of 6450 mother trees and 395 confirmed pisiferas is used.

The proposed planting material is constituted at 74 % of Deli * La Mé categories and 26 % of Deli * Yangambi categories. The characteristics of the planting material are averaging:

- Seeds quality:
  i. Purity: 99.9% of tenera palms
  ii. Quality backed and standardised through ISO 9001 – 2000 procedures
- Production (North Sumatra – NAD conditions):
  i. FFB: 28 to 32 tons / ha / year
  ii. OER: ≥ 26 %
  iii. CPO: 7 – 9 tons / ha /year
- Oil Quality:
  i. Iodine value: ≥ 54 %
  ii. RBD olein: > 76.9 %
  iii. B Carotene: ≥ 500 ppm

A part of this planting material presents some specific characteristics as:

- Tolerance to wilt disease
- High content of unsaturated fatty acids
- Less susceptible to drought conditions
- Very low vertical growth and reduced bulkiness

2. Vegetative Propagation laboratory

Since 2005, discussion is open with Cirad to open a Vegetative Propagation Laboratory. The objectives of this operation is to ensure the feasibility of the new process in larger scale condition, study the propagation strategy and develop at small scale – mainly for Socfindo or selected customers purpose – new planting material exploiting new characteristics described above and inaccessible through the sexual way.

Some interesting data

Crop of the Top 3s in the 1995 planting

	3 YEARS OLD	4 YEARS OLD	5 YEARS OLD	6 – 9 YEARS OLD
BN	32.43	31.83	24.97	18.74
FFB (kg / tree)	90.66	179.90	220.84	244.77
FFB (t / ha)	12.239	24.286	29.813	33.043
ABW (kg)	2.81	5.66	8.88	13.64
CPO (t / ha)	3.38	6.70	8.23	9.12
PK (t / ha)	0.53	1.04	1.28	1.42

The Top in extraction rate at Aek Loba Timur Breeding Block

P Group A	P Group B	Code	OER (%)	PKOER (%)	Total Oil (%)	GP Group A	GP Group B
BB 2137 D	BB 121 P	23/12	29.7	2.6	32.3	BB126DXBB150D	LM718TxLM238T
BB 2150 D	BB 97 T	17/06	29.3	2.0	31.3	BB126DxBB150D	LM718TxLM238T
PO 2816 D	PO 2981 P	04/15	29.3	2.4	31.7	DA10DxDA115D	LM2TxLM5T
PO 2893 D	PO 4991 T	13/03	29.2	1.3	30.5	DA10DxDA115D	LM5TxLM10T
PO 2631 D	PO 4989 T	08/05	29.8	1.8	31.6	DA10DxDA3D	LM5TxLM10T
PO 4907 D	PO 4102 P	27/18	29.7	2.5	32.2	DA115D II	LM2Tselfed
PO 3174 D	PO 4740 P	28/06	29.0	1.7	30.7	DA115Dselfed	(LM2TxSI10T)I
PO 3075 D	PO 2766 P	08/19	30.2	1.5	31.7	DA115Dselfed	LM10Tselfed
PO 3174 D	PO 2766 P	09/15	29.6	1.2	30.8	DA115Dselfed	LM10Tselfed
PO 3066 D	PO 2557 P	09/04	29.5	1.9	31.4	DA115Dselfed	LM2Tselfed
PO 3064 D	PO 4973 T	09/20	29.3	1.6	30.9	DA115Dselfed	LM5Tselfed
PO 3066 D	PO 4974 T	09/21	29.0	1.7	30.7	DA115Dselfed	LM5Tselfed
PO 3170 D	PO 2973 P	09/07	29.2	1.8	31.0	DA115Dselfed	LM5TxLM10T
PO 3174 D	PO 2973 P	09/08	29.4	1.3	30.7	DA115Dselfed	LM5TxLM10T
PO 3360 D	PO 4982 P	13/12	29.3	1.2	30.5	DA115Dselfed	LM5TxLM10T
PO 2988 D	PO 2762 P	03/09	29.7	2.0	31.7	DA115DxDA3D	LM2TxLM10T
PO 3367 D	PO 4973 T	03/19	29.3	1.4	30.7	DA115DxDA3D	LM5Tselfed
PO 4950 D	PO 4259 T	06/05	30.7	2.7	33.4	DA551DxDA767D	LM238TxLM511P
PO 2852 D	PO 4749 P	10/14	29.4	1.9	31.3	LM269DxDA115D	LM5Tselfed
PO 2704 D	PO 4799 P	10/13	29.0	2.0	31.0	LM269DxDA115D	LM5Tselfed
PO 3052 D	PO 4982 P	28/12	29.0	1.7	30.7	LM269DxDA115D	LM5TxLM10T
PO 4265 D	PO 4260 P	02/07	30.3	2.3	32.6	LM269DxDA128D	LM238TxLM511P
PO 4276 D	PO 3243 P	02/13	29.8	2.9	32.7	LM269DxDA128D	LM718TxLM238T
PO 4279 D	PO 3237 T	02/08	29.0	2.7	31.7	LM269DxDA128D	LM718TxLM238T
PO 3600 D	PO 2762 P	14/05	29.6	1.6	31.2	LM404Dselfed	LM2TxLM10T
PO 3600 D	PO 4238 P	28/20	29.0	1.4	30.4	LM404Dselfed	LM2TxLM5T
PO 3600 D	PO 4799 P	28/21	31.6	1.8	33.4	LM404Dselfed	LM5Tselfed
PO 3413 D	PO 2973 P	14/01	29.2	1.4	30.6	LM404Dselfed	LM5TxLM10T
PO 3600 D	PO 3243 P	28/22	30.3	2.4	32.7	LM404Dselfed	LM718TxLM238T

Crop in the Group III (PT SOCFINDO) 1999 - 2006

				FFB (t / ha)				
	1999	2000	2001	2002	2003	2004	2005	2006
Aek Loba	22.430	24.920	24.790	23.210	24.980	24.970	25.070	26.270
Padang Pulo				25.580	27.220	27.640	27.900	27.875
Negeri Lama	22.000	24.610	22.380	24.750	27.370	26.090	24.820	24.524

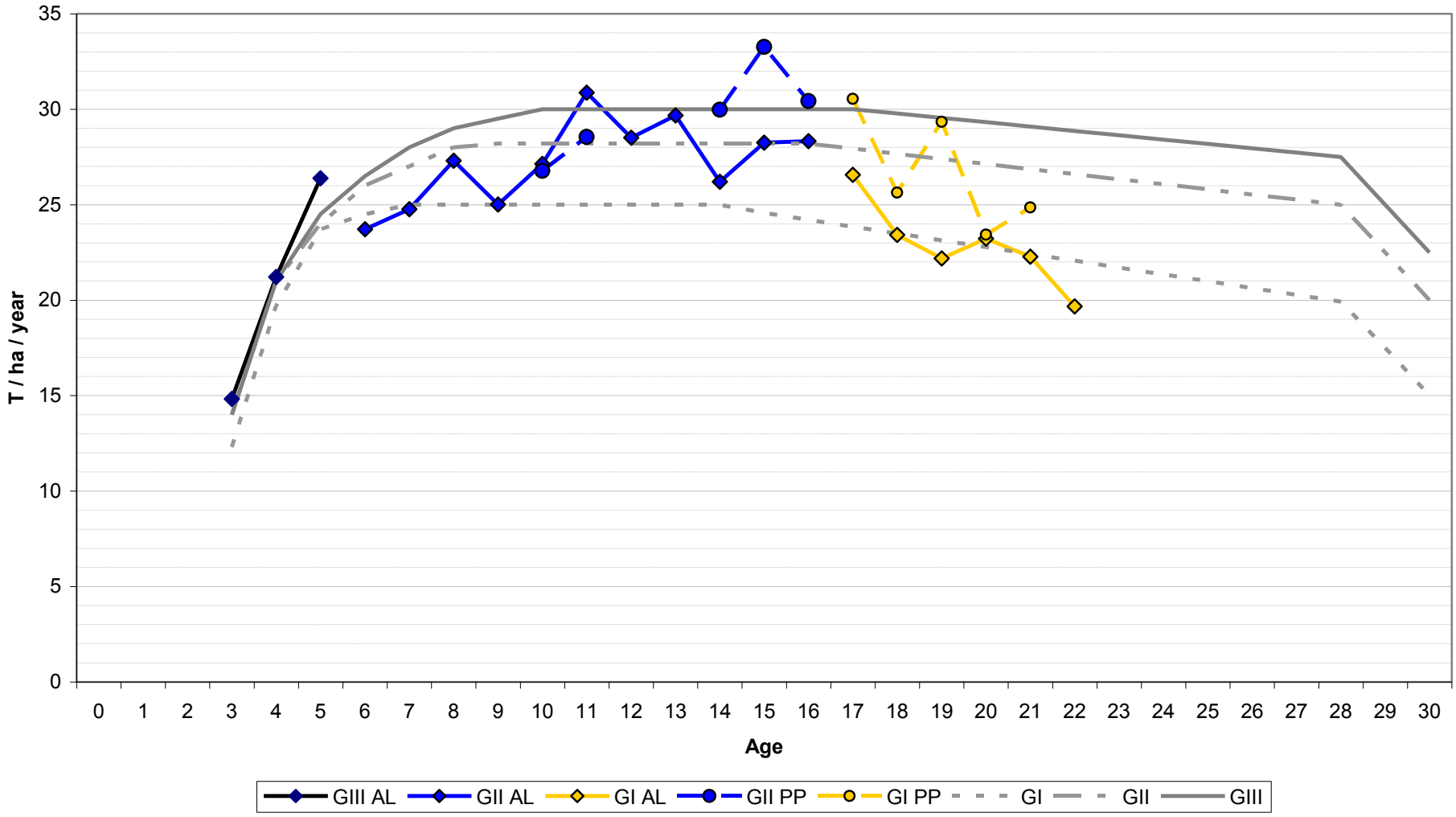
				OER (%)				
	1999	2000	2001	2002	2003	2004	2005	2006
Aek Loba	23.32	24.11	24.21	25.11	25.06	25.51	25.62	25.12
Negeri Lama	23.24	23.53	24.18	24.91	24.18	24.19	24.87	24.62

				KER (%)				
	1999	2000	2001	2002	2003	2004	2005	2006
Aek Loba	4.23	4.68	4.67	4.60	4.72	4.54	4.78	4.67
Negeri Lama	4.29	4.66	4.53	4.65	4.48	4.53	4.75	4.75

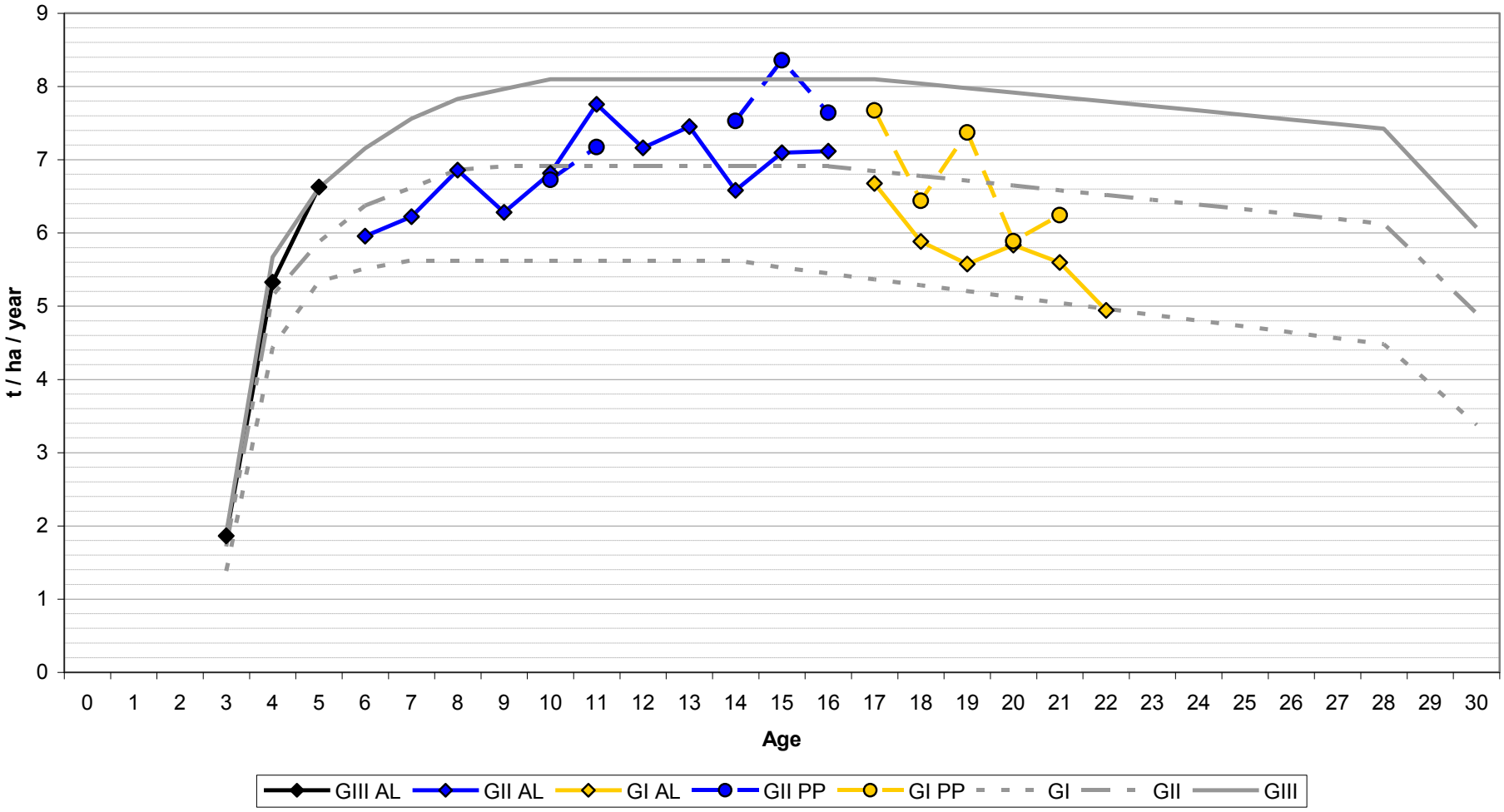
				CPO (t / ha)				
	1999	2000	2001	2002	2003	2004	2005	2006
Aek Loba	5.23	6.01	6.00	5.83	6.26	6.37	6.42	6.60
Padang Pulo				6.42	6.82	7.05	7.13	7.00
Negeri Lama	5.11	5.79	5.41	6.17	6.62	6.31	6.17	6.04

				Total Product(oil / t / ha)				
	1999	2000	2001	2002	2003	2004	2005	2006
Aek Loba	5.71	6.59	6.58	6.36	6.85	6.94	7.02	7.21
Padang Pulo				7.01	7.46	7.68	7.79	7.65
Negeri Lama	5.58	6.36	5.92	6.74	7.23	6.90	6.76	6.62

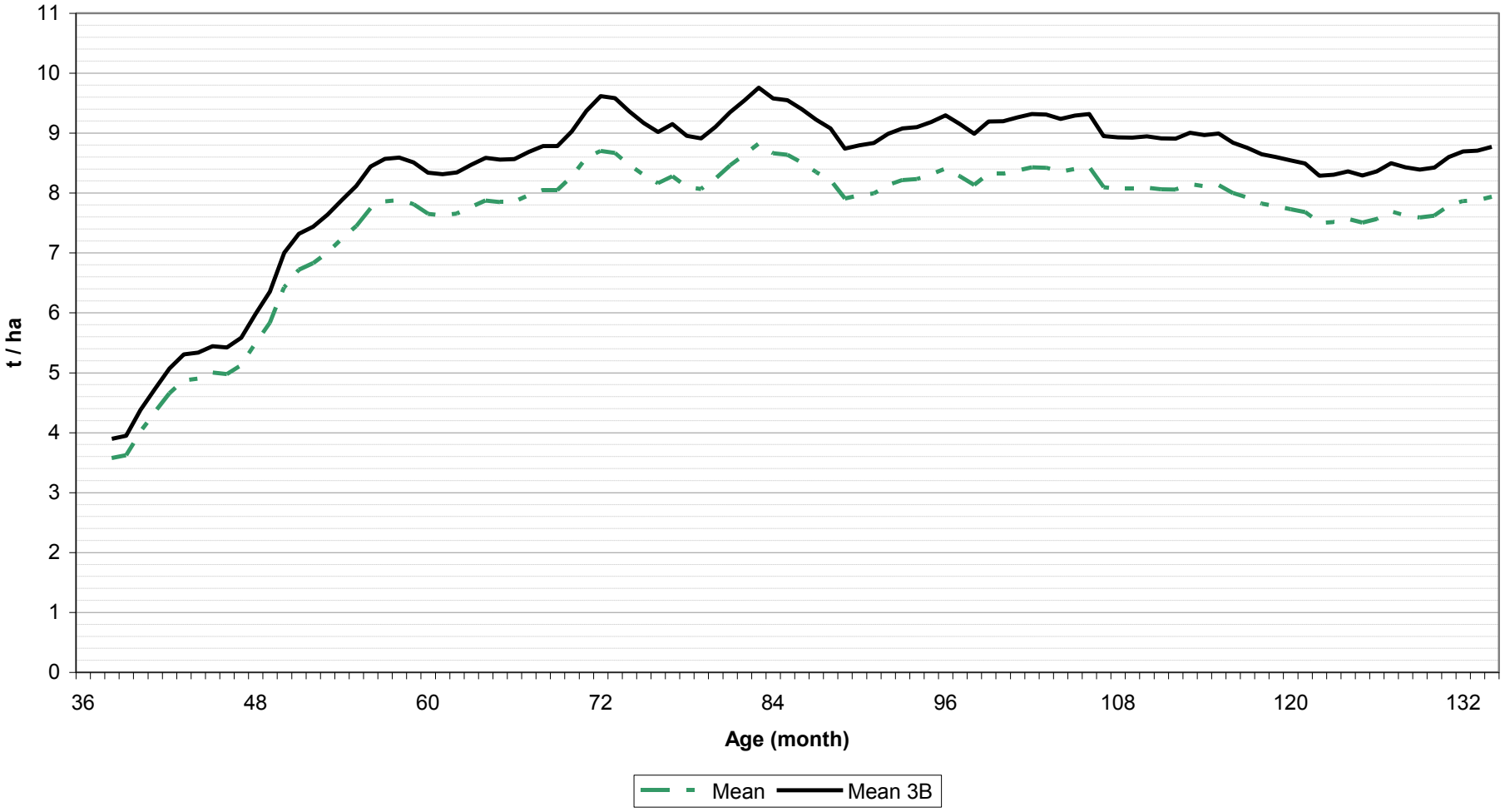
2006 FFB at AL & PP per generation



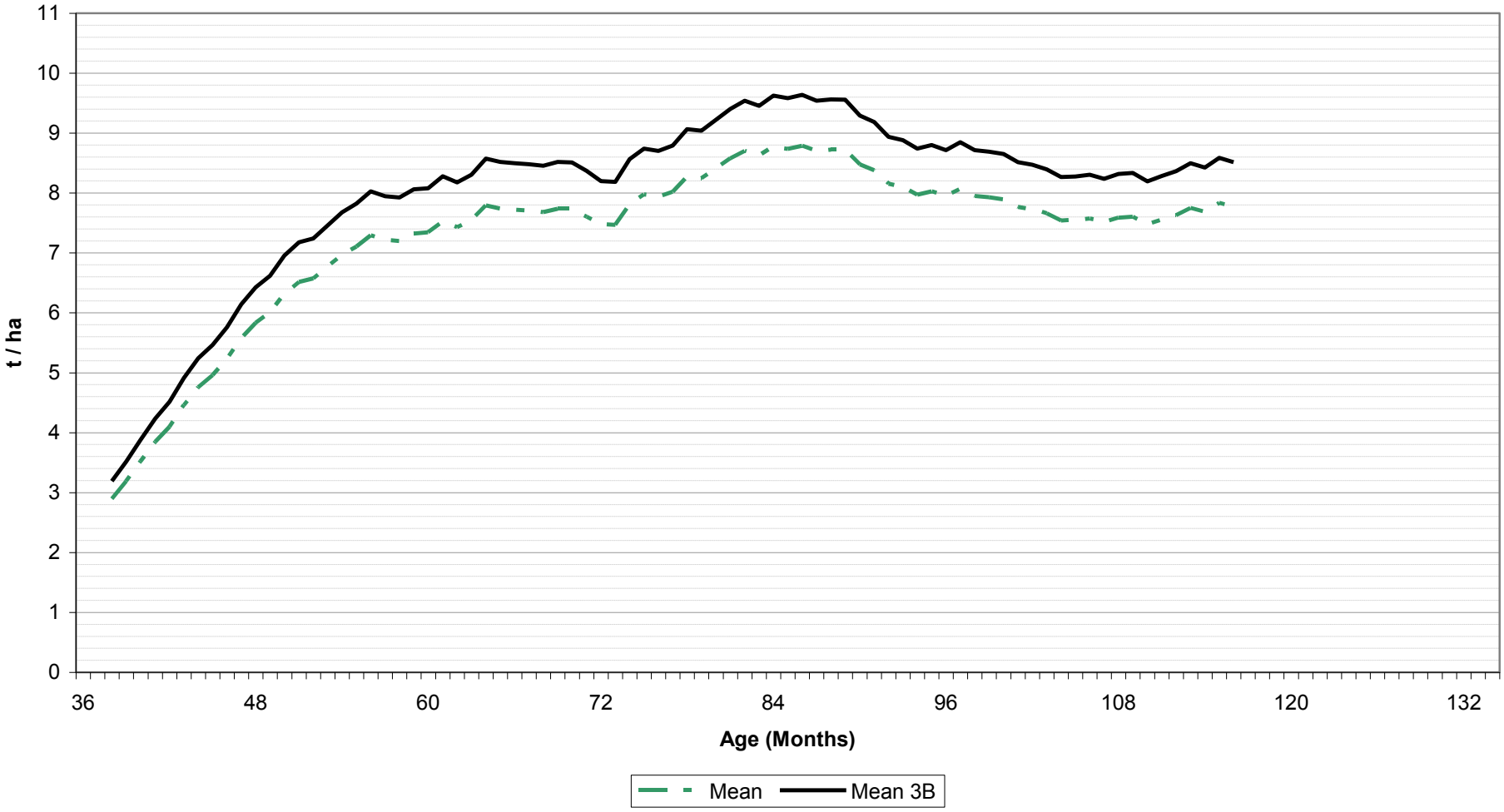
2006 CPO at AL & PP per generation
(But Mill OER)



CPO in 1995 Planting (12 months)
ALT Genetic Block



CPO in April 1997 planting
ALT Genetic Block



PT Socfindo Planting Material

Seeds quality:

Purity: 99.9% of tenera palms
Quality backed and standardised through ISO 9001 – 2000 procedures

Production (North Sumatra – NAD conditions):

FFB: 28 to 32 tons / ha / year
OER: ≥ 26 %
CPO: 7 – 9 tons / ha /year

Oil Quality:

Iodine value: ≥ 54 %
RBD olein: > 76.9 %
B Carotene: ≥ 500 ppm

Agronomic quality:

Suitable for wide range of soil and climatic conditions
Production less affected by water stress
Very low vertical growth and reduced bulkiness
More homogeneous

Economics:

Rapid return on investment with consistent first harvesting after 24 months

Crop Protection:

Wilt resistant material available (where required)